717

MULTIPLE-SAMPLE units of type shown (center) aid in design of equipment for bettering animal and vegetable fats and thus boost their food uses, such as those illustrated in side panels.

Advanced Food Processing With IMPROVED FATS AND OILS

1. Factors in Lard's Comeback
2. New Fats That Stay Plastic
3. Soybean-Oil Flavor Stabilized

¶ THE REGIONAL research laboratories of the Bureau of Agricultural & Industrial Chemistry, USDA, continue to devote considerable attention to utilization of animal and vegetable fats to the end that new and better uses will create increased demand for these farm products.

In this research both improved food and non-food uses are explored. In the former, emphasis is on lard, cotton seed, and soybean oils, which are already firmly entrenched in the food field. In the latter, are considered the inedible animal fats and foods of cotton seed and soybean oil which are now available in large quantities at low cost.

These studies, conducted in close collaboration with the industries concerned and their researches, are contributing to technological changes in the food fat field. While much remains to be done, the trend to the new is already apparent, as is reflected by the following reports.

1—FACTORS IN LARD'S COMEBACK

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Inclination to regard lard as a raw material completely interchangeable with other fats in the manufacture of shortenings, as indicated by the recent phenomenal rise in its use*, has come about as a result of many years of study of the chemistry of fats and oils.

This research has shown that lard contains essentially the same fatty acids as do vegetable oils and is equiva-

*In the period 1937-41 average annual amount of lard processed into shortening was 16,000,000 lb. In 1947 it was 101,000,000 lb.; in 1950, 177,000,000 lb.; 1951, 206,000,000 lb.; and in 1952 the total may approach 300,000,000 lb.

lent in digestibility and nutritive value.

It has further shown that lard's tendency to become rancid can be overcome in two ways: (1) by addition of edible antioxidants, and (2) by blending tocopherol bearing oils, such as cottonseed, peanut, and soybean, with it.

The latter method is especially beneficial because it permits greater latitude in selective hydrogenation than is possible with lard alone. This makes the process easier to control and, therefore, aids in obtaining the desired physical consistency.

And aside from the technological there are these points: A boost in consumption of the product is seen—which would be most favorable pricewise, considering the recent selling-level disparity, where vegetable oil has at times sold for twice as much as lard. What's more, products made by blending with vegetable oils cannot be called lard—an advantage because of past prejudices regarding lard's rancidity tendencies.

Physical Character Altered

Another important advance in the technology and use of lard can be attributed to the discovery that its physical character can be altered by mild treatment with sodium alcoholates, such as sodium methylate.

Apparently this treatment brings about rearrangement of the fatty acids in the glycerine molecules, although the actual chemical changes have not been completely established.

Lard, in common with many other fats and oils, does not have a strictly random distribution of the various fatty acids on the glycerol molecule.

The rearrangement treatment with catalysts such as sodium methylate causes an interchange of fatty acids between different glycerine molecules, and possibly even an interchange of acids on the same molecule. This interchange is random in character and, if the catalytic treatment produces maximum interchange, the resultant product would have a true random distribution of its glycerides.

The glycerine composition of completely randomized fats can be calculated providing the fatty acid composition is known. The latter can be readily determined by recently improved spectrophotometric methods.

Since the physical character of a fat is dependent on its glyceride composition, changes in this composition as effected by treatment would be reflected by changes in physical properties. Different fats, depending on how much their natural glyceride distribution differs from true random pattern, will be affected to a greater or lesser extent by the catalytic rearrangement.

Such treatment results in a product that has a wider plastic range than the untreated lard—i.e., it is more plastic and workable at lower temperatures and retains its plastic character at higher temperatures. Tendency to become "grainy" in appearance and texture is also reduced.

Makes Better Cakes

Rearranged lard used in cake formulations results in greater volume and lightness than when untreated lard is used.

Side products, such as small amounts of soap and methyl esters formed in the reaction of fats with sodium methylate, and also unreacted catalyst are removed by filtering, washing, and vacuum steam deodorization.

Although exact figures are not available, it is known that substantial quantities of the "rearranged" lard are being used in prepared bake mixes. It is estimated that between 60 and 100 million pounds of shortening are used annually in prepared mixes of all types.

Miscellaneous Uses

Other fields in which meat fats such as lard may find future application are frozen desserts and margarine. These possible uses require further research and development. However, in view of the economic advantage enjoyed by lard over butterfat and vegetable oils, it is logical to assume that a great deal of work is being done to expand its use in these fields.

The ERRL is conducting research, both fundamental and practical, on the chemical and physical changes which take place in fats subjected to various catalytic treatments.

Since knowledge of the changes in fatty acid and glyceride composition of fats is extremely important in this and many other investigations on fats, considerable attention is also being given to development of satisfactory methods for determining these fat compounds.

2—NEW FATS THAT STAY PLASTIC

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Two unrelated problems in the food fat field may be solved by new type fats developed through recent research.

One of these problems concerns the need for a plastic, but non-greasy, fat which might be used as a protective coating for food products.

The other relates to the search for an oil which will remain liquid, or at least highly plastic, at temperatures well below the freezing point of water—one which simultaneously possesses a relatively high resistance to rancidity and other forms of deterioration.

Solution of these two problems may be the substitution of acetic acid for a portion of the long-chain fatty acids found combined in certain of the ordinary fats and oils.

Hard Fats Made Plastic

Introduction of acetic acid into a hard fat or stearine, such as is produced by completely hydrogenating cottonseed oil, results in a product which solidifies in a waxy and generally translucent form. The waxiness has been traced to the presence of a specific type of fat crystal which, in acetostearins, is stable for all practical purposes.

Unlike ordinary plastic fats, which are really mixtures of liquid oil and relatively hard crystals of solid fat, these materials can be plastic even though they do not contain a liquid fraction. And unlike ordinary fats, which are hard and brittle when completely solidified, the acetostearins show no marked changes in plasticity with variations in temperature. Some of them can be quite plastic at both refrigerator and room temperature.

Melting points and other properties can be tailored within limits by varying conditions of preparation and composition of the hard fat used as starting material. Products with melting points in the range of 84-130 deg. F. can be prepared. And all have a relatively high resistance to oxidation—those made from hydrogenated cottonseed oil can be aerated at 208 deg. F. for 1,000 hr. without developing peroxides.

With the exception of the unusual properties just mentioned, the acetostearins resemble ordinary fats. Standard methods of purification render them practically odorless, colorless, and flavorless.

New Uses Seen

One of the possible uses for these products would be as a coating for wieners and other processed meats to retard loss of moisture and deterioration. Cheese is another type of food which might benefit from such a coating.

The low-melting acetostearins also have been tested as slab dressings in